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(54) **Stiff woven polyethylene fabric and process for the production thereof**

(57) A fabric 30 comprising an oriented polyethylene film 35 adhesively laminated to a woven structure 32 of oriented tapes 33, 34 through a layer 31 of synthetic plastic polymer such as polyethylene is produced by extruding the polymer layer 31 between the woven layer 32 and polyethylene film 35 to laminate the layers and has improved stiffness particularly useful when automatically closing the mouths of sacks made of this fabric after filling. When the polymer layer has a lace-structure with holes 36 produced by incorporating a blowing agent with the polymer on extrusion, the resultant fabric also has improved tear resistance. The ratio of the area of the holes 36 in the lace layer to the total area of the lace layer is preferably between 0.6 and 0.8.

Fig.1.

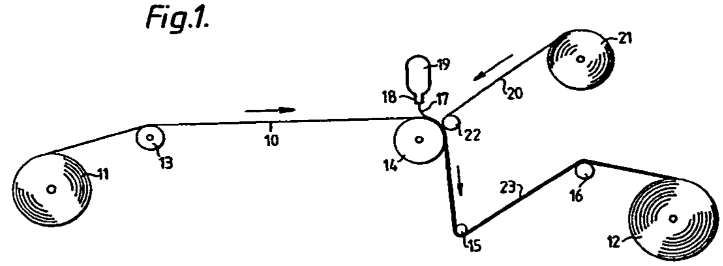
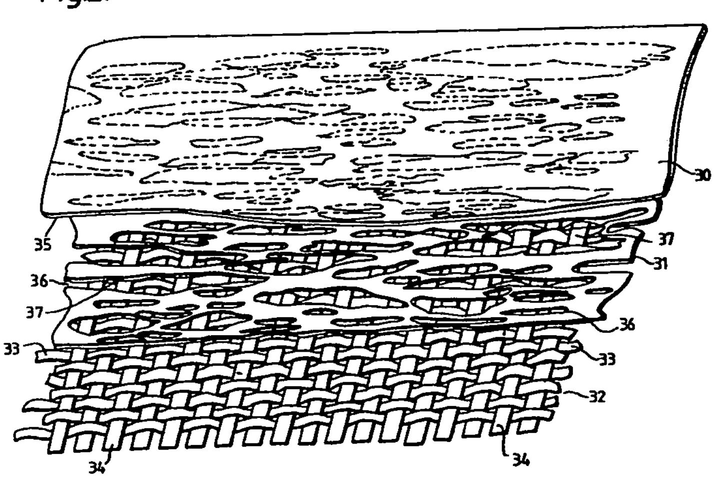


Fig.2.



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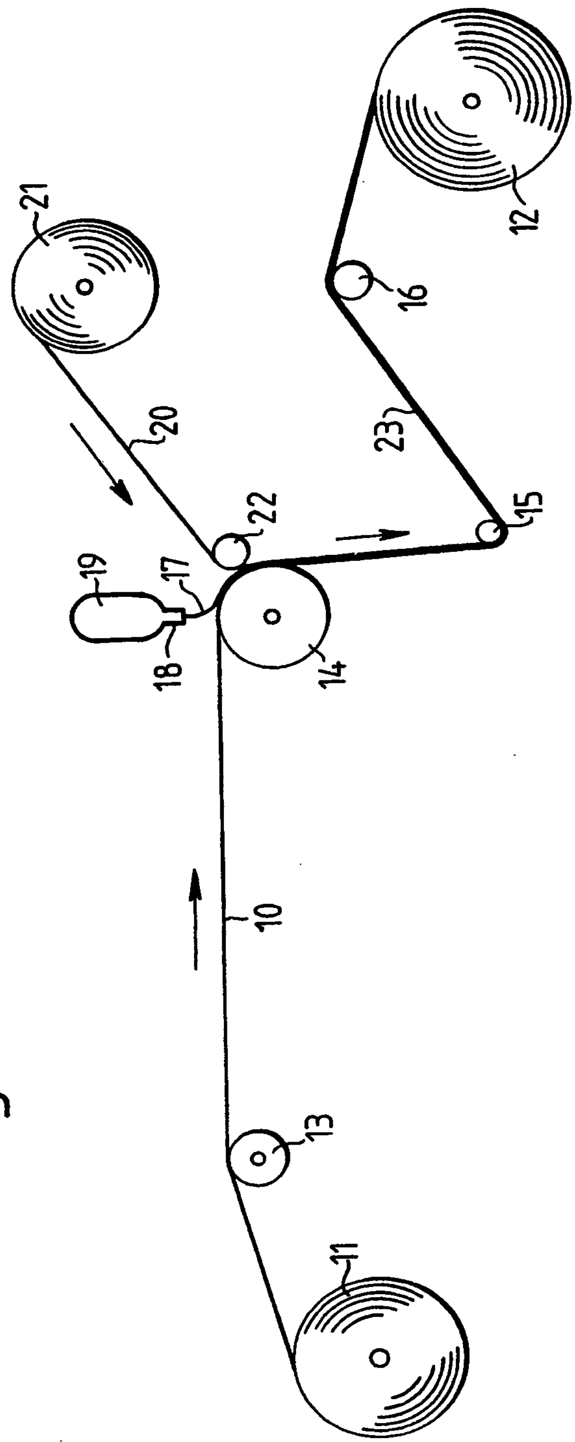

Fig.1.

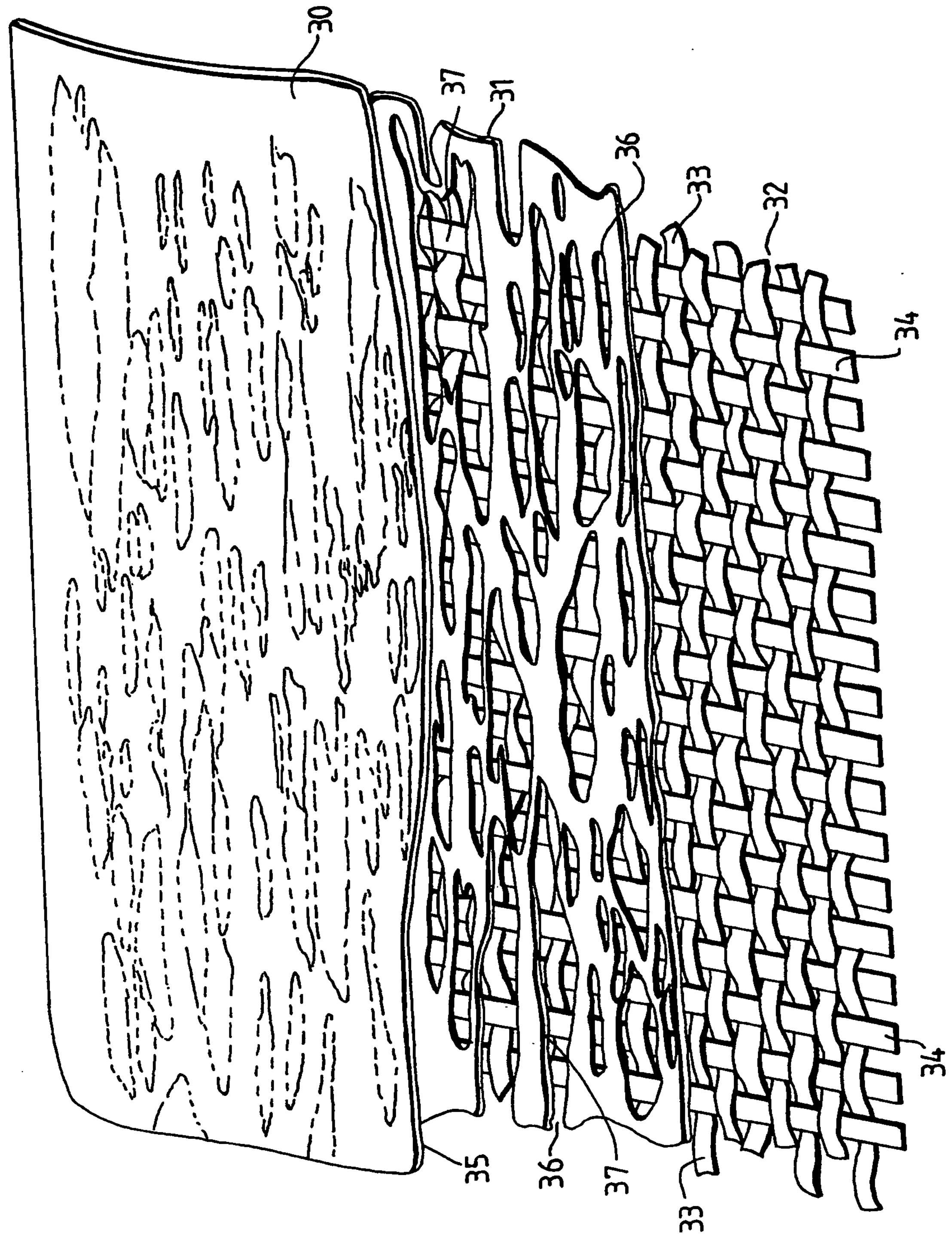

Fig.2.

SPECIFICATION

Stiff woven polyethylene fabric and process for the production thereof.

The present invention relates to a fabric, made from woven polyethylene tapes, which is useful for making industrial sacks.

It is known to make industrial sacks from fabrics of woven polyethylene tapes which have been extrusion coated with a layer of polyethylene. When used in some automatic sack making and filling methods many such commercial fabrics suffer from the disadvantage of being relatively limp. For example in one step in an automatic sack filling process a filled open-mouthed sack is advanced, open mouth upwards, towards a sewing station where the mouth of the sack is sewn closed. In such a sewing step it is desirable that the open mouth of the sack be stiff enough to prevent sagging of the walls of the mouth, which leads to malformation of the sewn mouth or to an incompletely sewn mouth. In the extreme the problem of an insufficiently stiff sack mouth may lead to jamming of the apparatus used to prepare the mouth for sewing and/or the sewing apparatus.

Known methods of stiffening the fabric include using tapes of a higher denier, e.g. using thicker tapes, tightening the weave of the tapes, or applying a thicker coating to the woven tape structure. However, these methods tend to make the fabric more expensive.

Another fabric made from woven polypropylene tapes coated with polypropylene does possess sufficient stiffness to be used in some automatic sack filling methods. A disadvantage of this polypropylene fabric however is that seams in the fabric must be joined either by sewing, or by a hot-melt seaming method which tends to be costly.

Accordingly to the present invention, there is provided a fabric comprising an oriented polyethylene film adhesively laminated to a woven structure of oriented polyethylene tapes through a layer of synthetic thermoplastic polymer.

The invention thus provides a polyethylene fabric which is substantially stiffer than previously known fabrics made from woven polyethylene tapes of similar weight per area. A particular advantage of this fabric is that seams may be made in it by heat sealing methods such as, for example, that disclosed in U.S. Patent 3 951 050.

In a preferred embodiment the polyethylene film is a monoaxially oriented polyethylene film made from polyethylene having a density between 0.940 and 0.970 g/cm^3 and the direction of orientation of the polyethylene film follows the direction of either the warp or weft tapes, preferably the warp tapes of the woven scrim structure.

In alternative embodiments the polyethylene film can be a biaxially oriented polyethylene film, a co-oriented laminated film, or a blown film, in each case made from polyethylene having a density between 0.940 and 0.970 g/cm^3.

The woven structure can be made from monoaxially oriented tapes of polyethylene having a density between 0.940 and 0.970 g/cm^3 and the synthetic thermoplastic polymer can be polyethylene, preferably polyethylene having a density between 0.910 and 0.955 g/cm^3.

It is found that a fabric having this improved stiffness and, moreover, improved resistance to tearing can be produced if the layer of synthetic thermoplastic polyer is of a lace-like structure.

Thus according to a further aspect of the present invention there is provided a fabric comprising an oriented polyethylene film adhesively laminated to a woven structure of oriented polyethylene tapes through a layer of synthetic thermoplastic polymer wherein said layer of synthetic thermoplastic polymer has a lace structure with a sufficient number of holes therethrough of an average size that provides a fabric having a tear strength in at least one of the transverse and machine directions substantially greater than the tear strength of a similar fabric produced with a continuous layer of the same synthetic thermoplastic polymer and of the same thickness as the lace layer.

This fabric is found to be both stiff and resistant to tearing and is therefore suitable for a considerable range of applications.

Preferably the ratio of the area of the holes is the lace structure to the total area of the lace structure is between 0.4 and 0.85, more preferably between 0.6 and 0.8, the term "total area of lace structure" meaning the area of the lace layer including the holes. Preferably, also, a substantial percentage of the holes in the lace structure have dimensions large enough that they extend over the width of at least one warp or weft tape of the woven structure.

The lace structure can be made from a polyethylene having a density between 0.910 and 0.955 g/cm^3 and containing a blowing agent in a sufficient amount to form the lace structure upon extrusion of the polyethylene.

Any blowing agent compatible with the thermoplastic polymer, e.g. polyethylene, may be used e.g. gases, volatile liquids, and solids capable of decomposing to form a gas. Examples of suitable blowing agents are CO_2, N_2, fluorocarbons, zinc carbonate, sodium bicarbonate, hydrated alumina and azodicarbonamide. It will be understood that some blowing agents, while functional, will not be selected because of, for example, their toxic properties, e.g. HCN.

Again, the oriented polyethylene film may be a mono-axially oriented polyethylene film, the direction of orientation of the polyethylene film being aligned with the direction of either warp or weft tapes, preferably

the warp tapes of the woven structure or a biaxially oriented film or a blown film, in each case made from polyethylene having a density between 0.940 and 0.970 g/cm^3.

The present invention also provides an article made from the fabric of the invention.

The fabric of the present invention may be made by a) weaving a woven structure of scrim from warp and weft tapes of oriented polyethylene, b) extrusion coating the scrim with a thin layer of polyethylene or other synthetic thermoplastic polymer which can adhere, both to the scrim and to an oriented polyethylene film; and c) laminating the coated scrim to an oriented polyethylene film.

Thus in a further aspect the invention provides a process for making a fabric comprising laminating an oriented polyethylene film to a woven structure or oriented polyethylene tapes by extruding therebetween a thin layer of synthetic thermoplastic polymer having the ability to adhere both to the film and the woven structure. The polymer may contain a blowing agent in an amount sufficient to cause the thin layer to form a lace structure on extrusion, in which case the process further includes the step of controlling the extrusion to such an extent as to provide the lace structure with a sufficient number of holes therethrough of an average size that provides a fabric having a tear strength in at least one of the transverse and machine directions substantially greater than the tear strength of a similar fabric produced with the same synthetic thermoplastic polymer devoid of a blowing agent extruded to form a thin continuous homogeneous layer of the same thickness as the lace structure.

The blowing agent may be selected from gases, volatile liquids, and solids capable of decomposition to form a gas e.g. zinz carbonate, sodium bicarbonate, hydrated alumina and azodicarbonamide. An especially preferred blowing agent is sodium bicarbonate in a concentration in the range of 1.0 to 3.0% by weight of the polyethylene used for extruding the thin layer.

Each of the three steps may be carried out using known methods. For example the oriented polyethylene film and the synthetic thermoplastic polymer may be applied simultaneously to the woven scrim so that the said polymer acts as a bonding agent to both the scrim and the film.

The present invention will now be illustrated by way of example with reference to the drawings wherein:

Figure 1 shows diagramatically the process of the invention; and

Figure 2 shows a cut-away sectional view of one embodiment of the fabric of the invention.

In the process of the invention, as seen in Figure 1 a web of scrim 10, made from woven polyethylene tapes, is transported from supply roll 11 to take-up roll 12 passing over idler rollers 13, 15 and 16 and chill roll 14. A thin layer of polyethylene 17 is extruded onto scrim 10 from a slot die 18 of extruder 19, at a position close to or at chill roll 14. Thin layer 17 is extruded onto the side of scrim 10 which is furthest away from chill roll 14. Simultaneously, oriented polyethylene film 10 is fed from supply roll 21 and around nip roll 22 onto thin layer 17. Nip roll 22 presses against chill roll 14, thus nipping the three-layer fabric therebetween. The chill roll causes solidification of this layer 17 and hence bonding of thin layer 17 to both scrim 10 and oriented film 20. The thus-laminated fabric 23 is wound up on take-up roll 12.

When the synthetic thermoplastic polymer layer is to be formed with a lace-like structure, a blowing agent is incorporated into the polymer on extrusion.

The blowing agent may be added to the synthetic thermoplastic polymer at the extruder. In the event that the blowing agent is a solid e.g. in powder form, it may be introduced into the throat of the extruder, typically using a weigh belt conveyor to control the rate of addition. In the event that the blowing agent is in liquid or gaseous form, it may be advantageous to introduce the agent directly into the barrel of the extruder.

The size and extent of elongation of the holes in the thin layer 17 may be controlled by the temperature of extrusion, the distance between the exit of die 18 and woven structure 10, the relative rates of travel of the woven structure 10 and oriented film 20 and of the thin layer upon emergence from the die, among other factors. The chill roll 14 also serves to "fix" or prevent further expansion of the holes in thin layer 17.

In the embodiment using monoaxially oriented film as one of the outer layers of the fabric, the film may be conventional monoaxially oriented film, or it may be co-oriented laminated film. Co-orientation lamination refers to a process involving essentially simultaneous orientation and lamination, and may be accomplished by bringing two polyethylene films into face-to-face contact and orienting the two contacting films longitudinally at a temperature below the melting point of the polymer of the film having the higher melting point. The polyethylene films may be the same, or different, and may be hompolymers of copolymers of ethylene, provided that the homopolymers or copolymers have a density between 0.940 and 0.970 g/cm^3.

One method for carrying out the co-orientation lamination involves passing the two contacting films over a first heated roll and subsequently over a second heated roll. The temperature of the first roll is kept higher than that of the second roll, and the surface speed of the second roll is at least 1.5 times the surface speed of the first roll, e.g. between 3.0 and 8.0 times the surface speed of the first roll. It is usual for the gap between the first and second rolls to be in the range of 1.2 to 5.0 mm, measured between their surfaces in a line joining the rotational centres of the rolls.

A preferred method for co-orientation lamination in which the two polyethylene films are the same involves taking tubular polyethylene film made by the blown film process, collapsing the film and subsequently co-orientation laminating as hereinbefore described.

The oriented film may also be blown film made from polyethylene having a density in the range of 0.940 to 0.970 g/cm^3. Such film may be made by a process such as, for example, that disclosed in Canadian patent 460 963. The blown film so formed is flattened and slit at the edges, thus forming two sheets, one of which may then be used as the oriented film of the present fabric. Such blown film process is operated preferably at

a blow-up ratio of between about 1.1 to 1 and 4.0 to 1.

The term "blow-up ratio" used herein means the ratio of the diameter of the expanded film tubing to the diameter of the circular die through which the tubing is extruded.

When monoaxially oriented film is used it is preferable that the direction of orientation of the film is in the direction of the warp tapes of the woven scrim.

Biaxially oriented film, useful as the oriented film used in the present invention, may be made by techniques known in the art.

It is preferred that the oriented film has a thickness in the range of from 15 to 50 μm, most preferably in the range of from 20 to 30 μm.

It is to be further understood that monoaxially oriented polyethylene tapes used to make the woven structure portion of the present fabric may be made by first extruding polyethylene film e.g. by the blown film process or the cast flat film process, slitting the film longitudinally to form a plurality of tapes and subsequently orienting the tapes individually in the machine i.e. longitudinal direction. Alternatively the monoaxially oriented tapes may be made by forming monoaxially oriented film e.g. by co-orientation lamination, and thereafter slitting said film into tapes, as disclosed for example in Canadian patent 1 041 005. The tapes are then woven into the scrim in a known manner.

It is preferred that the polyethylene tapes used in the scrim have a tape width in the range of from 1.2 to 6 mm, most preferably in the range of from 1.5 to 3.5 mm. It is also preferred that the tapes have a linear density in the range of from 550 to 2200 dtex, most preferably in the range of from 650 to 1450 dtex.

The selection of the polyethylene used for the extrusion coating step is not critical, although as is known to those skilled in the art certain polyethylenes may be easier to extrude than others.

The preferred synthetic thermoplastic polymer for making the lace-structure polymer layer is polyethylene having a density, prior to the addition of the blowing agent, of from 0.910 to 0.955 g/cm^3.

It is usual that the weaving step is done separately from the extrusion coating and laminating steps, primarily because the rate of weaving is much slower than the rate of extrusion coating and laminating. The last two steps i.e. extrusion coating and laminating are most conveniently done simultaneously as hereinbefore described in relation to the description of Figure 1. Lamination may however be carried out separately, using known techniques.

Figure 2 shows a fabric 30 in which the synthetic thermoplastic polymer layer 31 has the lace-like structure which is produced when a blowing agent is included in the polymer on extrusion.

The lace polymeric structure 31 is sandwiched between a structure 32 woven from warp tapes 33 and weft tapes 34 of polyethylene, and an oriented polyethylene film 35. Preferably the boundaries of a substantial number of the holes 36 in the lace structure encompass at least one tape cross-over in both the warp and weft directions. For example a woven structure having a 2.54 mm wide tape at about four tapes per centimeter in both the warp and weft directions should have holes in the lace structure at least as large as about 2.6 mm in the major and minor axes.

The shape of the holes in the lace-structure, when the fabric is made by the process of the present invention tends to be elongated. At higher extrusion temperatures and fast rates of travel of the woven structure and oriented film, the holes may appear somewhat "stringy" i.e. have thin strings of lace material passing across the hole as shown at 37 in Figure 2.

The ratio of the area of the holes to the total area of the lace structure may be measured by overlaying a sample of the fabric with a transparent sheet of material marked with a fine grid, and counting the number of squares of the grid overlaying the holes. Once this is known the ratio may be calculated as the number of squares overlaying the holes divided by the number of squares overlaying the sample. If the lace structure is coloured the ratio may be measured automatically using an image analyzer.

The fabric of the present invention is useful for making sacks, particularly those intended to be filled using automatic sack filling apparatus. Sacks may be made by folding the fabric longitudinally, bringing the edges together in abutting relationship and applying a joining strip over the abutting edges. A method and apparatus for accomplishing this is disclosed in U.S. Patent 3 951 050. The tube thus formed is cut into lengths appropriate for the sacks to be made therefrom. The tube is then flattened and one end of the flattened tube is sealed using a so-called "tape-over" seal. Essentially, this type of seal is formed by applying a wide polyethylene strip or strip of polyethylene-coated tape scrim over the end of the tube, using a hot melt adhesive.

The sack, when filled, may be sealed by sewing, or by the use of an adhesive or hot air sealing. Sewing tends to make the seal weaker than the other seals. A tape-over seal is preferred.

The improved stiffness of the present fabric gives a decided advantage in automatic sack filling operations, where stiffness of the mouth of the filled open sack is important for automatically closing the sack mouth. The fabric made with a continuous synthetic thermoplastic polymer layer may be easier to split under high stress e.g. when a filled 45 kg sack is dropped from a height of about 5m; the fabric made with a lace layer structure has greater tear resistance and is therefore suitable for applications in which these circumstances may occur. The fabric made in this way may have Modified Clark Stiffness values of between 90 and 200, while tear strengths may be between 120 and 250 N.

The following examples serve to illustrate the present invention: Examples 1 and 2 are comparative, Examples 3, 4 and 6 illustrate embodiments of the fabric of the invention incorporating a continuous synthetic thermoplastic polymer layer and Example 5 illustrates an embodiment incorporating a synthetic

thermoplastic polymer layer having a lace structure.

In *Example 1* which illustrates the prior art, a scrim was woven from 2.54 mm wide and 1000 dtex warp tapes and 3.43 mm wide and 1083 dtex weft tapes. Each of the tapes was made from oriented polyethylene having a density of 0.960 g/cm^3. The scrim structure had 3.55 ends/cm and 2.75 picks/cm. The scrim was extrusion coated with a 25 μm thick layer of polyethylene having a density of 0.923 g/cm^3.

In *Example 2*, which also illustrates the prior art, a scrim having 3.55 ends/cm and 3.55 picks/cm was woven from a 2.54 mm wide and 1089 dtex warp tapes and 3.43 mm wide and 1211 dtex weft tapes. The tapes were made from the same polyethylene as in Example 1. The scrim was extrusion coated with a 35 μm thick layer of polyethylene having a density of 0.923 g/cm^3.

In *Example 3*, which illustrates one embodiment of the present invention, a scrim having 3.55 ends/cm and 2.28 picks/cm, was woven from 2.54 mm wide and 667 dtex warp tapes and 4.45 mm wide and 1167 dtex weft tapes. The tapes were made from the same polyethylene as in Example 1. The scrim was extrusion coated with a 25 μm layer of polyethylene having a density of 0.923 g/cm^3 and a 25 μm monoaxially co-oriented laminated film of polyethylene having a density of 0.960 g/cm^3 was laminated to the coating of the coated scrim. The direction of orientation of the film was parallel to the warp tapes. The apparatus used for the process of making the fabric was as shown in Figure 1.

In *Example 4* a coated scrim was made similar to that of Example 1, except that the number of weft tapes was reduced to 1.58 picks/cm and the coated scrim was laminated as in Example 3, to a 20 μm layer of blown polyethylene film having a density of about 0.955 g/cm^3.

In *Example 5*, webs of structures woven made from oriented tapes of polyethylene having a density of 0.960 g/cm^3 were transported from a supply beam, past an extrusion coater and a chill roll/nip roll assembly, to a wind-up beam, substantially as shown in Figure 1 of the drawings. A thin layer of foamable polyethylene was extruded as a coating from a 36 cm wide extrusion coater having a die gap of 0.5 mm, onto the woven structure. The thus-coated woven web travelled a distance of about 13 cm before contacting a 1 m wide, 46 cm diameter chill roll kept at a temperature of about 10°C. A web of co-oriented laminated film was laminated to the coated woven structure by contacting the film and the coated structure at the nip roll which was adapted to nip the three layers between the nip and the chill roll.

In *Example 6* a laminate was made in the same way as in Example 5 but using a non-foamable polyethylene, thus forming a homogeneous extruded layer, for comparative purposes. Details of the materials used in Examples 5 and 6 are given in Table 1.

TABLE 1

Example	Woven Structure Ends/cm	Picks/cm	Extruded* Polyethylene	Extrusion Temperature (°C)	Film** Web
5	3.55	2.28	A	610	P
6	3.55	2.28	B	610	P

* A 2% of sodium bicarbonate in a polyethylene having a density of 0.923 g/cm^3.
* B A polyethylene having a density of 0.923 g/cm^3 devoid of any blowing agent.
** P 25 μm thick monoaxially co-oriented laminated film made from a polyethylene having a density of 0.960 g/cm^3.

TABLE 3

Example	Tear Strength (N) warp directions	weft	Modified Clark Stiffness warp directions	weft
5	222.4	133.5	104	163
6	177.9	71.2	144	188

Samples from Examples 1 to 6 were analyzed for Modified Clark Stiffness and Examples 5 and 6 were also tested for tear strength in the warp and weft directions.

Modified Clark Stiffness was measured using the Technical Association of Pulp and Paper Industries Standard T-451-m45, with the exception that two pieces of the sample were glued together in face-to-face relationship to minimize the effect of curl of the sample. Tear strength was measured by the procedure of ASTM D-2261-71.

The result of these tests are shown in Table 2 (Examples 1 to 4) and Table 3 (Examples 5 and 6).

TABLE 2

Example	Fabric Weight (g/m^2)	Modified Clark Stiffness Values Warp	Weft
1	91.5	65	50
2	115.3	83	96
3	94.9	144	188
4	98.3	136	75

A comparison of Examples 1 and 2 shows that the combination of increasing the weave density and the thickness of the tapes and of the coating gives only marginal improvement. A comparison of Examples 1 and 3, however, shows that a fabric of the present invention having about the same fabric weight per square metre as one of the prior art has a greatly increased level of Clark Stiffness.

Indeed, the fabric of Example 3 is superior in respect of Clark Stiffness to a fabric of polypropylene comprising a scrim having 4.73 ends/cm and 2.76 picks/cm woven from 2.54 mm and 1111 dtex warp and weft tapes, coated with a 36 μm layer of polypropylene copolymer.

A comparison of Examples 5 and 6 shows that the use of a lace structure as the synthetic thermoplastic polymer layer substantially improves the tear resistance of the laminate. The relative reduction in stiffness in the warp direction appears to be the result of elongation of the holes in the warp direction in the lace structure. Comparison with Examples 1 and 2 show that nevertheless the warp direction stiffness is improved relative to the prior art values.

CLAIMS

1. A fabric comprising an oriented polyethylene film adhesively laminated to a woven structure of oriented polyethylene tapes through a layer of synthetic thermoplastic polymer.

2. A fabric according to Claim 1 in which the polyethylene film is a monoaxially oriented polyethylene film made from polyethylene having a density between 0.940 and 0.970 g/cm^3 and the direction of orientation of the polyethylene film follows the direction of either the warp tapes or the weft tapes of the woven structure.

3. A fabric according to Claim 1 or Claim 2 in which the polyethylene film is a co-oriented laminated film made from polyethylene having a density between 0.940 and 0.970 g/cm^3.

4. A fabric according to Claim 1 in which the polyethylene film is a biaxially oriented polyethylene film made from polyethylene having a density between 0.940 and 0.970 g/cm^3.

5. A fabric according to Claim 1 in which the polyethylene film is a blown film made from polyethylene having a density between 0.940 and 0.970 g/cm^3.

6. A fabric according to any one of the preceding claims in which the polyethylene film has a thickness in the range of 15 to 50 μm.

7. A fabric according to any one of the preceding claims in which the polyethylene film has a thickness in the range of 20 to 30 μm.

8. A fabric according to any one of the preceding claims wherein the warp and weft tapes of the woven structure have a width in the range 1.2 to 6 mm.

9. A fabric according to Claim 8 wherein the warp and weft tapes of the woven structure have a width in the range 1.5 to 3.5 mm.

10. A fabric according to any one of the preceding claims whherein the warp and weft tapes of the woven structure have a linear density in the range 550 to 2200 dtex.

11. A fabric according to Claim 10 wherein the warp and weft tapes of the woven structure have a linear density in the range 650 to 1450 dtex.

12. A fabric according to any one of the preceding claims wherein the synthetic thermoplastic polymer is polyethylene.

13. A fabric according to Claim 12 wherein the synthetic thermoplastic polymer is polyethylene having a density between 0.910 and 0.955 g/cm^3.

14. A fabric according to any one of the preceding claims wherein said layer of synthetic thermoplastic polymer has a lace structure with a sufficient number of holes therethrough of an average size that provides a fabric having a tear strength in at least one of the transverse and machine directions substantially greater than the tear strength of a similar fabric produced with a continuous layer of the same synthetic thermoplastic polymer and of the same thickness as the lace layer.

15. A fabric according to Claim 14 in which the lace layer is made from a polyethylene having a density between 0.910 and 0.955 g/cm^3 and containing a blowing agent.

16. A fabric according to Claim 15 wherein the blowing agent is selected from the group consisting of zinc carbonate, sodium bicarbonate, hydrated alumina and azodicarbonamide.

17. A fabric according to any one of Claims 14 to 16 wherein the ratio of the area of the holes in the lace layer to the total area of the lace layer is between 0.4 and 0.85.

18. A fabric according to Claim 17 wherein said ratio is between 0.6 and 0.8.

19. A fabric substantially as herein described.

20. An article made from the fabric of any one of the preceding claims.

21. A process for making a fabric comprising laminating an oriented polyethylene film to a woven structure or oriented polyethylene tapes by extruding therebetween a thin layer of synthetic thermoplastic polymer having the ability to adhere both to the film and the woven structure.

22. A process for making a fabric comprising laminating an oriented polyethylene film to a woven structure or oriented polyethylene tapes by extruding therebetween a thin layer of synthetic thermoplastic polymer having the ability to adhere both to the film and the woven structure which polymer contains a blowing agent in an amount sufficient to cause the thin layer to form a lace structure upon extrusion thereof, and controlling the extrusion to such an extent as to provide the lace structure with a sufficient number of holes therethrough of an average size that provides a fabric having a tear strength in at least one of the transverse and machine directions substantially greater than the tear strength of a similar fabric produced with the same synthetic thermoplastic polymer devoid of a blowing agent extruded to form a thin continuous homogeneous layer of the same thickness as the lace structure.

23. A process according to Claim 22 wherein the extrusion of the synthetic thermoplastic polymer is controlled so as to provide the lace structure with a ratio of the area of the holes in the lace structure to the total area of the lace structure between about 0.4 and 0.85.

24. A process according to Claim 23 wherein said ratio is between about 0.6 and 0.8.

25. A process according to any one of Claims 22 to 24 wherein the blowing agent is selected from the group consisting of zinc carbonate, sodium bicarbonate, hydrated alumina and azodicarbonamide.

26. A process according to Claim 25 wherein the blowing agent is sodium bicarbonate at a concentration in the range of 1.0 to 3.0% by weight of the polyethylene used for extruding the thin layer.

27. A process according to any one of Claims 21 to 26 wherein the synthetic thermoplastic polymer is polyethylene having a density between 0.910 and 0.955 g/cm^3.

28. A process for making a fabric substantially as herein described.

29. A fabric produced by the process of any one of Claims 21 to 28.

30. A fabric substantially as described in any one of Examples 3, 4, 5 and 6 herein.

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